

# Boiling-Off Silk

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## RINSING THE SILK

Rinsing out the soap held by the boiled-off silk is one of the delicate operations of silk dyeing which, if carried out improperly, gives rise to a large number of difficulties in subsequent operations. The complete removal of the soap is almost impossible in practice, for the following reason: If a neutral solution of fairly neutral soap, 1 part of soap by weight to 1,000 parts of water, and dilute it with 10 volumes of distilled water to 1 of the solution, giving a soap content of 1 part in 10,000, an alkaline reaction is disclosed by phenolptaline. If this solution is then exactly neutralized and again diluted, the alkaline reaction reappears. This phenomenon shows clearly that diluted soap solutions set at liberty alkali on one hand and on the other hand a more acid soap or even fatty acid.

When silk carrying soap is rinsed in a large volume of water this separation takes place and a small proportion of fatty acid remains fixed on the fibre. It is this fatty acid which gives to silk that special handle which is called *craquant* in the mill. The silk therefore is to be rinsed in such a way as to leave a trace of acid, enough to give the *craquant* and eliminate the remainder. To accomplish this result the following conditions are necessary:

1. Avoid first of all the formation of insoluble salts with an earthy base which become fixed on the silk.

2. Retard the separation of the soap so that the quantity of fixed fatty acid on the fiber may be sufficient and not too large.

3. Produce this separation at the right moment and complete it by the action of an acid. This is the process of *avivage*, which completes the rinsing.

An examination of the three points will give us the explanation of and the key to good conditions for rinsing:

1. Avoid the formation of all earthy soaps or insoluble alkaline salts. It is at this point that the full importance of pure water becomes evident. If silk loaded with soap is rinsed in water containing salts of lime or magnesia, there is immediately formed by double decomposition an insoluble lime or magnesia soap which becomes firmly fixed on the fiber and can be removed only with great difficulty by subsequent treatment. The presence of this insoluble soap changes completely the luster and imparts a very disagreeable touch to the silk. I have even seen in one mill where the silk was rinsed in defective water, the fabrics carry all the lime soaps that they took up, and when dried after certain finishing operations they gave out a decided odor of rancid grease.

It is therefore necessary to rinse the silk in water that is free from lime and magnesia. Natural water can be used when it does not show over 4 or 5 hydrometric degrees. Above that it is necessary to purify the water.

2. Retard the separation of the soap so that the quantity of fixed fatty acid on the fiber may be sufficient and not too large. To attain this result it is necessary:

- (a) To use a soap for boiling-off that does not separate too easily. This property is found only in the soaps in which the fatty acids are liquid at ordinary temperatures or that liquify at a slightly higher temperature. These soaps are said to "rinse well." Those generally used are oleine and olive oil soaps.

- (b) Prevent the separation of the soap at the beginning of the rinsing process in a weak solution of carbonate of soda which does not separate the soap like pure water and holds the fatty acid in solution in the form of basic soap. This process is called *lisbordage* in French mills.

3. Produce this separation at the right moment and complete it by the action of an acid. When the silk has been freed from the excess of soap by rinsing in an alkaline bath clear water is applied, which removes at first the carbonate of soda and then causes the separation of the soap. At this moment the silk acquires the touch known as *craquant*.

Does this separation fix on the fibre an acid soap or a fatty acid? This question has never been satisfactorily answered. I consider the former hypothesis the more probable because the ulterior action of the acid increases materially the *craquant* touch. This action of the acid takes place in practice during the operation of *avivage*, which consists in passing the pieces or yarn through a dilute acid bath. The object of *avivage* is not only to give the silk a distinct touch, but also has a close relation with the operation of dyeing and it generally is practised after these last named operations have been completed.

Having dealt with the theory we are now in a position to describe the practice of rinsing. The boiled-off silk is first extracted in order to remove the greater quantity of the soap solution that still remains on the fiber. The mechanical conditions of this operation vary with the class of goods being handled. Next follows the rinsing in an alkaline solution called *lisbordage*, which is simply a weak solution of carbonate of soda intended to remove the excess of soap without separating it. In the case of delicate fabrics which cannot be extracted it is a good plan to repeat this treatment, and this is also the case with certain goods which it is necessary to free from the slightest trace of soap.

The same mechanical devices are used for the alkaline bath as for the boiling-off process except that the spreader is used only in the soap bath. The boiled-off pieces are rinsed in rope form in a tub. The temperature of the alkaline bath is kept between 100° and 120° F. After this alkaline rinsing the material is rinsed several times in soft or purified water. It is during these rinsings that the last traces of soap begin to separate and the silk begins to acquire the peculiar touch. There are various models of machines used for rinsing the various kinds of silk goods. A description of them does not come within the scope of this article, but will be found in general works on dyeing and in the catalogs of the builders.

In conclusion it would be well to state that rinsing is very important in connection with the succeeding operations in dyeing. It is nearly impossible, for example, to give silk the right amount of weighting if it has not been well rinsed after boiling-off.